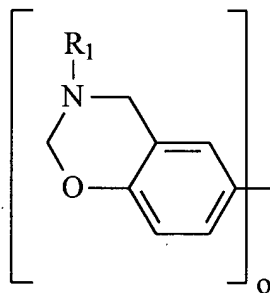


WHAT IS CLAIMED IS:

1. A heat curable composition comprising:

(a) a benzoxazine component comprising

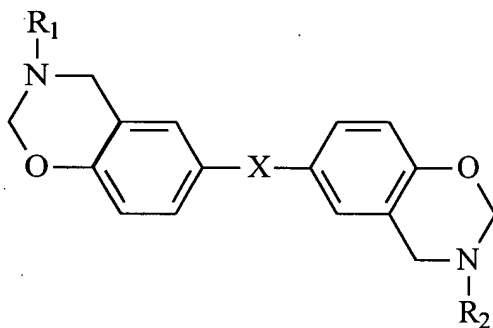


wherein o is 1-4, X is a direct bond (when o is 2), alkyl (when o is 1), alkylene (when o is 2-4), carbonyl (when o is 2), thiol (when o is 1), thioether (when o is 2), sulfoxide (when o is 2), and sulfone (when o is 2), and R₁ is alkyl; and

(b) a toughener component comprising acrylonitrile-butadiene co-polymer having secondary amine terminal groups.

2. A heat curable composition comprising:

(a) a benzoxazine component comprising

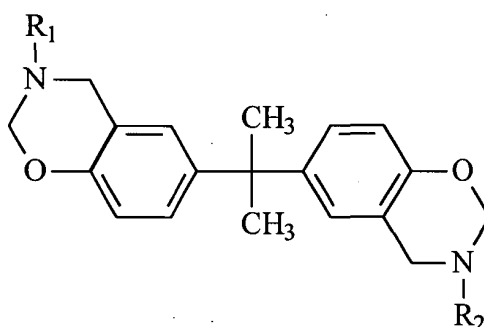


wherein X is selected from the group consisting of a direct bond, CH₂, C(CH₃)₂, C=O, S, S=O and O=S=O, and R₁ and R₂ are the same or different and are selected from the group consisting of methyl, ethyl, propyls and butyls; and

(b) a toughener component comprising acrylonitrile-butadiene co-polymer having secondary amine terminal groups, wherein cured reaction products of the composition are capable of demonstrating at least one of a wet Tg of at least 350°F, a toughness measured by GI_c of at least 1.9 in-lb./in², a percent decrease in ΔH of at least 15% compared with a benzoxazine prepared from bisphenol F and aniline, and a percent decrease in wet Tg compared with dry Tg with increased toughener concentration of less than 6%.

3. A heat curable composition comprising:

(a) a benzoxazine component comprising

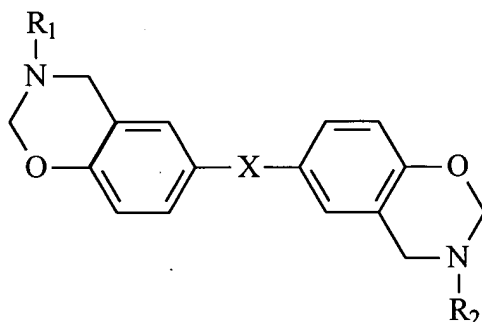


wherein R₁ and R₂ are the same or different and are selected from the group consisting of methyl, ethyl, propyls and butyls; and

(b) a toughener component comprising acrylonitrile-butadiene co-polymer having secondary amine terminal groups, wherein cured reaction products of the composition are capable of demonstrating at least one of a wet Tg of at least 350, a toughness measured by GI_c of at least 1.9 in-lb./in², a percent decrease in ΔH of at least 15% compared with a benzoxazine prepared from bisphenol F and aniline, and a percent decrease in dry Tg compared with wet Tg with increased toughener concentration of less than 6%.

4. A heat curable composition comprising:

(a) a benzoxazine component comprising

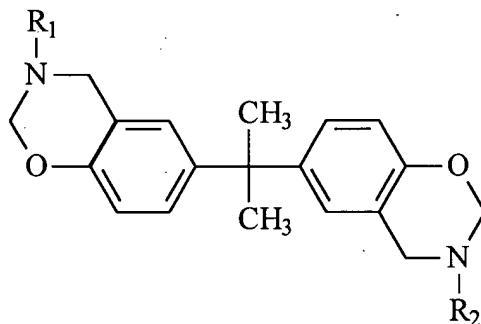


wherein X is selected from the group consisting of a direct bond, CH_2 , $\text{C}(\text{CH}_3)_2$, $\text{C}=\text{O}$, S, $\text{S}=\text{O}$ and $\text{O}=\text{S}=\text{O}$, and R_1 and R_2 are the same or different and are selected from the group consisting of methyl, ethyl, propyls and butyls; and

(b) a toughener component comprising acrylonitrile-butadiene co-polymer having secondary amine terminal groups, wherein T_g and toughness measured by GI_c increase as the amount of toughener in the composition increases.

5. A heat curable composition comprising:

(a) a benzoxazine component comprising



wherein R_1 and R_2 are the same or different and are selected from the group consisting of methyl, ethyl, propyls and butyls; and

(b) a toughener component comprising acrylonitrile-butadiene co-polymer having secondary amine terminal groups,

wherein Tg and toughness measured by GI_c increase as the amount of toughener in the composition increases.

6. The heat curable composition of Claims 1-5, having a cured density of less than 1.2 g/cc.

7. The heat curable composition of Claims 1-5, wherein component (a) is present in an amount in the range of about 10 to about 99 percent by weight, based on the total weight of the composition.

8. The heat curable composition of Claims 1-5, wherein component (b) is present in an amount in the range of about 1 to about 90 percent by weight, based on the total weight of the composition.

9. A prepreg comprising a layer of fibers infused with the heat curable composition of Claims 1-4.

10. The prepreg of Claim 9, wherein the fiber layer is made from unidirectional fibers.

11. The prepreg of Claim 9, wherein the fiber layer is made from woven fibers.

12. The prepreg of Claim 9, wherein the fiber is selected from the group consisting of carbon, glass, aramid, boron, polyalkylene, quartz, polybenzimidazole, polyetheretherketone, polyphenylene sulfide, poly p-phenylene benzobisoxazole, silicon carbide, phenolformaldehyde, phthalate and naphthenoate.

13. The prepreg of Claim 12, wherein the glass is a member selected from the group consisting of S glass, S2 glass, E glass, R glass, A glass, AR glass, C glass, D glass, ECR glass, glass filament, staple glass, T glass and zirconium oxide glass.

14. The prepreg of Claim 12, wherein the carbon is a member selected from the group consisting of polyacrylonitrile, pitch and acrylic.

15. Cured reaction products of the prepreg of Claims 8-14.

16. A process for producing a prepreg, steps of which comprise:

- (a) providing a layer of fibers;
- (b) providing the heat curable composition of Claims 1-5; and

- (c) joining the heat curable composition and the layer of fibers to form a prepreg assembly, and exposing the resulting prepreg assembly to elevated temperature and pressure conditions sufficient to infuse the layer of fibers with the heat curable composition to form a prepreg.

17. A process for producing a prepreg, steps of which comprise:

- (a) providing a layer of fibers;
- (b) providing the heat curable composition of Claims 1-5 in liquid form;

(c) passing the layer of fibers through the liquid heat curable composition to infuse the layer of fibers with the heat curable composition; and

(d) removing excess heat curable composition from the prepreg assembly.

18. A prepreg made by the process of Claim 16.

19. A prepreg made by the process of Claim 17.

20. Cured reaction product of the prepreg of Claim 18.

21. Cured reaction product of the prepreg of Claim 19.

22. A towpreg comprising:

(a) a bundle of fibers infused with the heat curable composition of Claims 1-5.

23. The towpreg of Claim 22, wherein the fibers are selected from the group consisting of carbon, glass, aramid, boron, polyalkylene, quartz, polybenzimidazole, polyetheretherketone, polyphenylene sulfide, poly p-phenylene benzobisoxazole, silicon carbide, phenolformaldehyde, phthalate and napthenoate.

24. The towpreg of Claim 23, wherein the glass is a member selected from the group consisting of S2 glass, E glass, R glass, R glass, A glass, AR glass, C glass, D glass, ECR

glass, glass filament, staple glass, T glass and zirconium oxide glass.

25. The towpreg of Claim 23, wherein the carbon is a member selected from the group consisting of polyacrylonitrile, pitch and acrylic.

26. Cured reaction products of the towpreg of Claims 22-25.

27. A process for producing a towpreg, steps of which comprise:

- (a) providing a bundle of fibers;
- (b) providing the heat curable composition of Claims 1-5; and

(c) joining the heat curable composition and the bundle of fibers to form a towpreg assembly, and exposing the resulting towpreg assembly to elevated temperature and pressure conditions sufficient to impregnate the bundle of fibers with the heat curable composition to form a towpreg.

28. A process for producing a towpreg, steps of which comprise:

- (a) providing a bundle of fibers;
- (b) providing the heat curable composition of Claims 1-5 in liquid form;

(c) passing the bundle of fibers through the liquid heat curable composition to impregnate the bundle of fibers with the heat curable composition; and

(d) removing excess heat curable composition from the towpreg assembly, thereby forming a towpreg.

29. A towpreg made by the process of Claim 26.

30. A towpreg made by the process of Claim 27.

31. Cured reaction product of the towpreg of Claim 29.

32. Cured reaction product of the towpreg of Claim 30.

33. An adhesive composition comprising the heat curable composition of Claims 1-5.

34. The adhesive compositions of Claim 33, further comprising one or more of an adhesion promoter, a flame retardant, a filler, a thermoplastic additive, a reactive or unreactive diluent, and a thixotrope.

35. Cured reaction product of the adhesive composition of Claim 33.

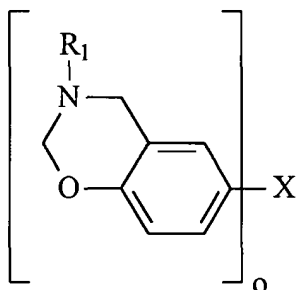
36. An adhesive film comprising the heat curable composition of Claims 1-5.

37. The adhesive film of Claim 36, further comprising a support selected from the group consisting of nylon, glass, carbon, polyester, polyalkylene, quartz, polybenzimidazole, polyetheretherketone, polyphenylene sulfide, poly p-phenylene benzobisoxazole, silicon carbide, phenolformaldehyde, phthalate and naphthenoate.

38. Cured reaction product of the adhesive film of Claim 36.

39. A process for producing a heat curable composition, steps of which comprise:

(a) providing a benzoxazine comprising



where o is 1-4, X is a direct bond (when o is 2), alkyl (when o is 1), alkylene (when o is 2-4), carbonyl (when o is 2), thiol (when O is 1), thioether (when o is 2), sulfoxide (when o is 2), sulfone (when O is 2) and R₁ is alkyl;

(b) providing with mixing a toughener component comprising acrylonitrile-butadiene co-polymer having secondary amine terminal groups; and

(c) mixing the benzoxazine and the toughener component under conditions appropriate to produce the heat curable composition.